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AN INTERBEHAVIORAL ANALYSIS OF PROPOSITIONS

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AN INTERBEHAVIORAL ANALYSIS OF PROPOSITIONS

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Two diametrically opposite attitudes may be taken toward the current vigorous discussion of propositions and their relation to such linguistic things as sentences and statements. On the one hand, we may conclude that the intensive study of the linguistic and logical aspects of propositions indicates an increased understanding of the latter and a fair promise of logical progress in addition. On the other, we may be so deeply impressed by the contrasting treatments of propositions as to decide that no study in the logical domain could be less rewarding.

Basic to the disagreements so lavishly displayed in the descriptions of propositions are undoubtedly the wide differences in philosophical background which yield diverse conceptions of the nature of logic. Thus logicians who cling to classical philosophies are involved with the ontological contents of propositions or with mind and its rational processes such as inference and judgment. The more recent logicians imbued with the tenets of logical positivism or empiricism and who wish to avoid classical metaphysics propose to do so by stressing language factors.[1] In the case of both the classical and symbolic logicians there is noticeably lacking a satisfactory psychological position from which the nature and function of language can be adequately surveyed.

Our purpose then in the present paper is to offer three suggestions that may prove serviceable in clarifying propositional problems. First, we indicate a general interbehavioral approach to scientific and logical work. This approach is offered to replace the traditional epistemological and ontological pronouncements. Secondly, we point out how the objective psychology implied by the interbehavioral approach may help in distinguishing and analyzing logical and linguistic events. And, finally, we specify how an interbehavioral analysis and interrelation of psychology, language and logic clarify the nature and function of propositions.

THE INTERBEHAVIORAL APPROACH

The basic assumption of the interbehavioral approach is that all scientific and logical work consists of interbehavior of individuals with (1) things and events, and (2) the products of such interbehavior.

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[1] We are not suggesting here that the logical positivists substitute language for things in the scientific as differentiated from the logical domain.

Interbehavior with Events. Science and logic like all other human enterprises are essentially activities of persons by way of manipulating, talking or speculating about all sorts of materials with which they are directly in contact or indirectly acquainted through speech and script. Even when one believes that one is endowed with supernatural powers one is still interbehaving with oneself, though here we must distinguish between proper and improper action. Moreover, when persons inter-act with things that exist only as verbal or pictorial creation (Pegasus, dimensionless points, mermaids, or the paranoiac's trillion dollars or identity with Napoleon) he is similarly demonstrating interbehavior.

In anticipation of later discussion the interbehavior with words or language deserves special mention. Here are to be distinguished (1) referential and symbolic and (2) scriptural and epigrammatic lan-guage. The former belongs to situations in which persons are referred to or otherwise kept in contact with spatio-temporal objects and events. In the latter case the contacts do not go beyond the words, and are exemplified by the epigrams: "There exists an absolute moral law," "I am master of all I survey."

At this point it is expedient to consider the question of novelty. A commonplace of elementary psychology is that novel creations exist only by virtue of various definite interactions with things which are transformed by such interbehavior as abstracting, extrapolating, inter-mixing, emphasizing, analogizing and rearranging. What is really known by everybody is strangely overlooked by students of logical deduction and scientific method. Surely they forget that they can in no sense transcend the human scene or dictate to nature except by acts of the strictest obedience.

When we consider the continuity between original things and events and the elaborate technological creations we find no necessity to construct descriptions of events on different levels of existence or subsistence. The interbehavior of persons with things is in principle like that of the interbehavior of any thing with any other, so that psychic entities or powers are eliminated. Since even all objects con-stitute interbehavioral systems, for example, the interbehavior of molecules of a magnet or of water, we may regard an observational event as interbehavior with interbehavior.[2] It may be a trite but never-

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[2] Cf., Kantor, J. R., Toward a Scientific Analysis of Motivation. *Psych. Record*, 1942, 5, 225-275.

theless important suggestion that to inject mind or consciousness as non-spatio-temporal factors into a description of an observation is a heritage from prescientific thought. It may be asserted forthwith that the interbehavioral principle in psychology involves no factors different in principle from those of physics.

Implied in the interbehavior with events is that actual individuals come into contact with specific events. At once there is excluded from science and logic all descriptions made in terms of vague generality. It is such descriptions which lead to metaphysical theories and purely verbal statements. The interbehavioral approach is opposed to happenings in general, to ultimates and totalities, and to notions of equal ignorance. On the contrary, it leads to genuine natural history in science and to controllable system-building in logic.

Interbehavior with Products. The significance of stressing interbehavior with products is that all human enterprises, whether intellectual, scientific or practical, occur upon historically successive levels. If we trace the evolution of any particular science or discipline we discover its beginnings in interbehavior with things on a simple, practical or commonsense level. As every historian of science must point out, astronomy has its roots first in casual and unsystematic observations of prehistoric time and later in astrologically organized but unacceptable formulations. Likewise, when scientific chemistry began with Lavoisier nine of his thirty-three elements were known from hoary antiquity, whereas ten turned out not to be elements at all.

Precisely here lies the importance of the interbehavioral approach—namely, the insistence that the worker and his work remain constantly in the foreground. Especially must the fact be kept alive that all later developments in science or logic, no matter how complicated, are definitely based upon contacts of persons with earlier stages of the same things. The importance of holding the worker and his interbehavior in view is evident from the following considerations selected from a large number.

(1) Since all complex enterprise finds individuals immersed in elaborate cultural accumulations resulting from prior interbehavior, the scientific worker is not only concerned with things and events but with intellectual traditions. Intermixed in his discipline are innumerable, practical and general human interests. Hence doctrinal trends are engendered in which national, cultural, and practical human interests

and motives are intermingled. Who can say how much the fortunes of science are conditioned for good or evil by such factors! Consider how the development of mathematics was obstructed by the persistence of the Britishers not to assimilate the Continental calculus. Why could Kant celebrate the completion and perfection of classical logic? That we are not involved here with developments dependent upon absolute powers of particular minds is attested by the fact that after Boole, Schroeder, Peano, Frege, and others did develop modern symbolic logic the historian went back to Kant's predecessors to piece together the developmental continuity from the various beginnings. Adequately to keep before us the worker means, of course, including in our investigation the conditions under which he works.

(2) Because certain behaviors prove interesting or fruitful they set the style of thought and investigation. On a large scale this fact is illustrated by the penchant which workers develop for the exact as over against the inexact sciences with the result that the social sciences remain backward despite their importance. Smaller scale sequelae are exemplified by various lags in scientific investigations; for example, Frauenhofer's spectroscopic studies were unappreciated because at the time scientists were inordinately interested in the competing claims of the wave and emission theories. Similarly, objective psychology can make but slow headway when the persistence of psychical doctrine influences the preservation of psychic states by the procedure of interpreting them in physical terms.

(3) When we concern ourselves with a worker and his work we readily see how certain methods that prove useful in science and logic become ends in themselves, and thus perhaps can avoid this outcome. Even statistical and experimental procedures not only become bases for neglecting events at the time not amenable to treatment by such methods, but also for misconstruing the events they do treat. When the psychologist develops an intelligence quotient he is prone to confuse his arbitrary measure and statistical results with the actual interbehavior which originally stimulated his work. When physicists like Mach, Duhem and Poincaré observe that mathematical symbols constitute the best way to record and represent events, they risk the danger of regarding mathematics as a form of language. Again, the rigor that logicians discover in deduction leads them to suggest that it is the scientific method *par excellence*.

Interbehavioral Implications for Science. Probably the basic implication of the interbehavioral approach for science is that the materials interacted with are never produced in the act of observing them, no matter how complicated the observation. No investigation or experiment creates the crude or preanalytic events which originally stimulate the interests of the scientist. Scientific writings are full of suggestions to the effect that things consist of "sense data" which are presumably processes of knowing instead of qualities of things known. Also "physical objects" are alleged to be scientific constructions as well as "reality". Both of these ideas are summed up in the curious question concerning the existence of an external world.

Here we must distinguish between crude and analytic events.[3] As to the former, we need only indicate that these are the things and events with which individuals interact on any level. While scientific crude data may be complicated transformations of things met with in prescientific situations, they maintain their continuity with those things.

Analytic data in general consist of described, recorded, and interpreted events. These are constructions developed after the worker has been in contact with crude events. Such constructions comprise hypotheses, which direct investigation, and theories and laws constituting explanations and interpretations of the preanalytic events.

By no means should crude and analytic data be confused. Frequently highly refined analytic constructions are treated as basic or crude factors in a scientific situation. For example, psychologists and physiologists treat light radiation as a thing interbehaving with the retina and producing a result described as color quality.[4] Such intermixture of crude and analytic data leads to unsatisfactory scientific results.

Another difficulty arises from imposing analytic data on crude events. No matter how complex and abstract our scientific structures they issue from basic interbehavior and possess no transcendent value or reality not found in the original observed events. This view contradicts sharply the idea now so prominent that there is more "reality" in pointer readings or measurements than the events measured. Implicit in the latter view is that the body of scientific doctrine may carry in it assumptions or prejudices not derived from original interbehavior.

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[3] Cf., Article cited in footnote 2.

[4] Cf., Kantor, J. R., A Survey of the Science of Psychology. Bloomington, Indiana, 1933, pp. 32-33.

That numbers are more basic or real than qualities may be traced back to the kind of civilization that gave birth to Pythagoras.

Now it is obvious that all such ideas issue from actual interbehavior of persons with things. It is frequently overlooked, however, that so-called subjectivity, privacy or uncertainty of knowledge arise from such contacts with crude events as result in modifying and distorting them. To be sure, interposition of insufficient and distorting tools of investigation may conceal and modify the crude data, but the converse that original data are created by the method used is not acceptable.

Just as imperfect investigative techniques distort and disturb original data so efficient techniques obviously help to increase contact with things and events. We do not limit ourselves here to the new observational powers engendered by a 200-inch telescope or an electron microscope, but go further to the actual intensification of natural events which result in novel facts. The production of higher and lower temperatures than those with which we are ordinarily in contact and the production of enormous pressures constitute events which illustrate the range of human interbehavior.

This range is further indicated by the unexpected discoveries made while engaged in other observations. To keep to the physics of light alone, Newton's discovery that light consists of difform rays with different refrangibilities was made while attempting to improve the refracting telescope; also Frauenhofer discovered the sodium line while working on refraction indices of glass for different colors.

It is a merit of the interbehavioral view that it need not discriminate against any sort of preanalytic events. When events are approached as objects of free investigation we are not limited to non-human things and actions, but may include all humanistic happenings such as social organization and the materials of civilization which definitely arise through human agency. Moreover, our investigative procedures and theoretical constructions can be regulated by the kind of events studied. Descriptions and laws are not imposed on one kind of material because of success in handling another, but are derived from the particular data interbehaved with.

Another basic interbehavioral implication for science is that all the individual's powers of observation and creation are outgrowths of long series of contacts with things in the evolution of science. Whenever scientific results are pyramided so that new discoveries are made either

by accidental observation or planned transformation they imply a spiralling effect that always reaches down to the original contacts with things. In other words, there are no magical powers inherent in scientists to create realities. What actually happens is that constructions are made and then regarded as more important and fundamental than the events originally interbehaved with. But, after all, interbehavior is prior to everything.

Thus, from contacts of individuals with colored objects have arisen theories of color, the distinction between color and wave frequencies, etc. Out of observation of mechanical work and various changes resulting from work have developed the capacities to produce such products as theories of energy, laws of mechanics and thermodynamics. From interbehavior with radiation, electrical phenomena, and light has evolved the ability to make all sorts of scientific transformations and applications and to achieve laws of electricity.

Notions of transcendent powers are certainly not derived from the study of man in interbehavior with things. Quite the reverse, such views are intermixed with beliefs bred by man's wishes and aspirations and the traditional cult systems which feed upon such aspirations. The aspirations themselves, to be sure, have developed from contacts of persons with lack of basic necessities, from their sufferings attributable to unsatisfactory contacts with other persons and the tyranny and oppression of states or classes.

Interbehavioral Implications for Logic. Though logic as a human enterprise is in essential respects like all other members of the group no one wisely overlooks the detailed differences. Logical workers operate with definite materials and construct products under specific cultural auspices; in consequence, like scientists, they are subject to various temporary and historical ideological influences.

The first important interbehavioral implication, then, concerns the logician's operational field. It is important to mark out what the logician works at, the limits of his work and products, and the interrelation of his work with that of other workers.

All these points can be readily and briefly indicated by considering one outstanding characteristic of logicians, namely, their general expansiveness of attitude. Instead of regarding their work as specific and specialized they think of themselves as general lawgivers or norm providers for all other workers. This is a consequence, of course, of

the traditional notion that logic is concerned with reason, with the rational basis of theology, of science and of every other discipline. Though in the history of logic the notion of comprehensiveness and ultimacy takes on various forms, at no point does the logician realize that even when he is concerned with the most abstruse and generalized materials he is still interbehaving with a particular type of subject-matter.

Dialectic and deductive logicians since the Scholastic era regarded themselves as able to transcend nature; they thought they could prove propositions about heavenly as well as earthly matters. To achieve their purpose they simply created (verbally) powers for man which were exaggerated magnifications of what they observed him to be able to do. From an interbehavioral standpoint it is clear that their ambition stemmed from a dissatisfaction with general human conditions, whereas their means of carrying it out they derived from observing local acts of inference and argument.

Though the so-called inductive logicians regarded themselves as simply concerned with the methods of science they presumed to prescribe generalized procedures for dealing with things. In the meantime they were oblivious to the actual procedures of scientists in dealing with concrete things and events. Furthermore, inductive logic as a technical and universal discipline lost contact with logic's historical concern with linguistic systems.

Is it not clear, then, that whatever transcendence is achieved by a logician is verbal construction and therefore a factor in a definite interbehavioral field as we have indicated. The notion of a priori logic in the sense that the human mind can transcend concrete interbehavioral domains is simply the acceptance of certain traditions evolved in western European culture since the time of the Greeks.

The more recent formal or deductive logicians who are no longer interested in transcending things directly have turned to ultimate processes of inference and reason. The materials they work with are primarily relations, as in the case of discovering the systematic basis of mathematics. Their products consist of systems of relations. All these they handle by means of propositions sometimes regarded as sentences, but at other times as that which the sentences represent or symbolize. Here there is an opportunity of adopting an interbehavioral view, so that logic becomes concerned with the formation and transformation of systems of propositions.

Could such a view of logic prevail, logicians would look upon themselves as engaged in a specialized enterprise. Instead they regard themselves as concerned with processes much more fundamental and more powerful than the construction of propositional systems, namely, with epistemological and other philosophical issues. The contrast between the two views is illustrated by the following questions logicians ask concerning propositions. (a) Are propositions identical with or different from (1) expressions or formulation of judgments, opinions, and inferences, or are they (2) statements of relations between objects? (b) Are propositions (true) identical with facts or are they formulations or constructions concerning facts? (c) Do sentences or propositions as a whole refer to or represent things and events or do only their term or word constituents do so?

ISOLATION OF LOGICAL PROPOSITIONS

As a first step in carrying through an interbehavioral analysis of propositions we must properly isolate our data—namely, distinguish (1) logical from general or non-logical propositions, as well as (2) separate all types of propositions from non-propositional objects of inquiry such as (a) linguistic acts (asserting, stating, symbolizing), (b) intellectual acts (judging, opining, believing, etc.), (c) linguistic products (sentences, statements, symbols, questions), (d) things and events (organic, non-organic, humanistic).

Logical and Non-logical Propositions. It is a defensible assumption that there is a definite continuity between logical propositions and those belonging to non-logical domains. We are obliged, then, to indicate the likenesses and differences between these different types.

The criterion marking off logical from non-logical propositions is their inclusion or non-inclusion respectively in systems. Such inclusion is two-fold. Propositions may be logical because one places them in propositional organizations, for example, syllogisms, propositional algebras and mathematical systems. Or, the inclusion derives from placing propositions in systems because one wishes to organize certain materials, whether things, events, relations, both linguistic and non-linquistic. Since propositions are always constructions concerned with materials this alternative inclusion is a matter of emphasis.

Propositions and Non-propositional Objects of Inquiry. Proposi-
tions, logical or non-logical, must be separated from related objects of
inquiry. Thus we distinguish between the following.

(a) *Propositions and linguistic acts.* Writers on logic frequently
identify propositions, which are constructions concerning what does
or does not exist or proposals concerning what should exist, with
acts of asserting, proclaiming, or stating propositions and non-proposi-
tions. It is inevitable that A would be unaware of B's propositional
creations (hypotheses, theories, speculations) unless he heard them
proclaimed or read about them. But such inevitability merely makes
necessary that we keep the two things distinct.

Similarly, it is frequently true that A understands his own proposi-
tions better if he refers to them vocally or records them. Thus if both
the creation of propositions and their linguistic concomitants are to
be understood they must be kept distinct. But even such writers as
Cohen and Nagel who ordinarily sharply separate the linguistic from
the propositional factors declare that the assertions "This is a mirror,"
"That sound is a dinner bell," are propositions denoted by the term
"fact."[5] They go even further to say that such propositions interpret
what is given to us in sense experience.

There are two objections to these statements. In the first place,
both logical and non-logical propositions are not simply assertions or
linguistic acts. The mere inspection of the two illustrations makes it
easy to distinguish between such assertions and both logical and non-
logical propositions. No one need confuse the simple interbehavioral
situation in which such assertions are made (performed) with the more
complicated situation in which propositions, whether non-logical or
logical, are constructed. For purposes of propositional analysis it is
wise at this point to avoid any transforming of these quoted assertions
into script, that is, transcriptions of the assertions. To make such a
transformation not only would result in confusing written sentences
with propositions, but also in improperly identifying acts of assertion
with transcribed sentences.

Again, it is a confusing metaphor to say that propositions assert
or deny. As Ducasse points out, "A proposition does not assert or

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[5] Cohen, M. R., and Nagel, E., An Introduction to Logic and Scientific
Method. New York, Harcourt Brace, 1937, p. 218.

deny anything; *we* assert or deny *it*."[6] The statement that a proposition asserts implies the identification of a transcribed sentence with a proposition and then the ascription of assertive function to the sentence. For the proper isolation of propositions we must point out the great difference between (1) making assertions and transcribing them and (2) the acts of constructing propositions and representing or symbolizing them.

(b) *Propositions and thinking.* From an interbehavioral standpoint it is obvious that propositions arise from acts of construction. Still, it is of the greatest importance to distinguish between acts and their products. Certainly we must not confuse propositions with acts other than those concerned with their production. Now while it is true that if we take into account the entire range of propositions some of them are constructed in connection with such acts as believing, opining, judging, thinking and reasoning, they may however be independent of them. Thus propositions or proposition construction must be segregated from thinking and other similar interbehavior.[7]

(c) *Propositions and sentences.* Likewise, propositions must be separated from sentences, statements and other symbolic or textual products set up to designate, record, symbolize or refer to them. This distinction has recently loomed up as extremely important among mathematical logicians. Quine[8] especially has been stressing this point. Although he regards himself as dealing with statements instead of propositions he makes much of the distinction between use and mention of statements, and statements and the names of statements. It follows that propositions are even more remote from linguistic texts that simply refer to or designate assertions or matters of fact.

(d) *Propositions and things.* And finally we isolate propositions from acts, things, and events concerning which propositions are constructed. Though most logicians are guiltless of such a confusion, some err in this respect especially in the case of true propositions and facts.

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[6] Ducasse, C. J., Propositions, Opinions, Sentences, and Facts. *J. of Philos.*, 1940, 26, 701-711, p. 710. Hereafter we refer to this article as P.O.S.F.
  [7] Cf., Ducasse, C. J., P.O.S.F.
  [8] Quine, W. V., Mathematical Logic. New York, Norton, 1940. Hereafter referred to as M.L.

TERMINOLOGICAL PROBLEMS IN PROPOSITION ANALYSIS

Granting that (1) logical propositions, (2) general propositions, (3) acts of judging, affirming, believing, etc., (4) linguistic acts and things, and (5) events related to and sometimes identified with propositions are all different things we still have achieved only the first step in proposition analysis. In addition we have to inquire whether the various items are satisfactorily separated as tested by some achievement in investigation. We propose then to apply our isolating technique to the following two terminological problems selected from a large number in logical writings.

(1) Misinterpreting the nature and function of logical propositions because of terms used. Writers who surely do not disagree that logic is concerned with propositions yet insist upon calling them sentences or statements. (2) Interpreting the term *proposition* in an undesirable manner and then assuming that propositions have no place in logic. Especially in recent years writers have revolted against the term *proposition* although it is clear that they are only objecting to a particular interpretation of the term and that they in no wise are opposed to actual propositions.

As to (1), what advantage does Tarski[9] gain by avoiding the term proposition in favor of sentence, or Quine[10] in rejecting the term proposition in favor of statement? Here the following questions are in order. (a) Is logic not reduced to language or symbolic texts? Even if the materials of logic are identified with systems of propositions, are the processes of constructing them purely linguistic or do they have a larger scope? (b) If logic should be identified with mathematics, is the latter to be only descriptions of achieved relations or are the discovery and construction of those relations also to be taken into account?

We are not objecting to the use of any name which a writer may consider more useful or more effective for his purposes, but rather the assumption that the use of a different name clearly involves a different thing. If we use the term propositional function for matrix as well as property[11] we may object to that term, but in view of the fact that there is no absolute language or perfect name we are merely obliged

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9 Tarski, A., Introduction to Logic. New York, Oxford Univ. Press, 1941.
10 Quine, W. V., M.L.
11 Cf., Quine, M.L., p. 121 note.

to specify exactly our referent or designatum. Fundamentally we are insisting upon an analysis of the work of the logician and his field of operation. By observing the logician at work we may then distinguish between the worker making assertions, predicating something or other, setting up an equation, or building up a system of whatever sort.

In the case of (2) we have a more serious situation. Here we confront the assertion that there are no propositions or that they are not necessary in logic.[12] The present situation can be clarified by observing that the objectors interpret propositions as Scholastic reals or essences or identify them with acts of judging and asserting or with things about which judgments or assertions are made. On these bases the objectors are correct in excluding propositions. But the question here is whether such interpretations and identifications are necessary or vitally touch the problems of propositions or logic.

To illustrate these points consider first Ryle's examination of the arguments in favor of and against propositions.[13] In this instance propositions are taken to be subsistential objects of thought as in the Bolzano, Brentano, Frege, Meinong, Husserl tradition ostensibly established in refutation of psychologistic logic. Ryle's conclusion, based upon the premise that in knowing and thinking one is concerned with existences or facts, is that there is really no place for propositions unless the name denotes a "sentence" or "statement". In more vigorous language Black says propositions are bastard intermediaries between sentences and facts.[14]

We are in whole-hearted accord in rejecting such subsistential things as the only referents for the term propositions; nevertheless we do not agree that such creations cannot be dealt with, howsoever futilely, from the standpoint of more preferred occupations. Certainly Bolzano, Frege and the other Scholastics or Realists wrote much about them. Further, we dissent from the view that propositions created from more acceptable enterprises than Scholastic logic need to be dispensed with. And finally we object to transforming logic into enterprises of believing and knowing. The argument of Ryle and Black is a misplaced one because when we are concerned with logical propositions we are certainly not primarily interested in epistemo-

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12 Writers mentioned under (1) may also share these views.
13 Ryle, G., Are there propositions? *Proc. Aristot. Soc.*, 1929-30, 30, 91-126.
14 Black, M., *A propos* of 'Facts', *Analysis*, 1933-1934, 1, 39-42.

logical situations. Logical situations constitute enterprises of construct-
ing systems although it is true that the materials of some of these
systems consist of propositions concerning facts either in the sense of
things, sentences or assertions.

Another attempt to set logical propositions aside is that of Kap-
lan and Copilowish[15] on the basis of shifting from logic to semiotic.
These writers dispense with propositions by displacing them with
"implicit behavior" which is something that happens to or 'in' the
organism when an organism uses signs. This implicit behavior, whether
described behavioristically or in terms of images and which they call
an interpretation, is "occasioned" by a sign-vehicle (something with a
sound or shape) which is a member of a sign. Signs they regard as
classes of sign-vehicles. Further, they assert that each sign-vehicle is
associated with a law of interpretation which describes its usage, that
is, its occasioning of an interpretation. The series of interpretations is
called the interpretant.

Applying this construction to logic the authors assert "A senten-
tial sign is *true* if and only if there exists a situation of such a kind
that a correct interpretation of any sign-vehicle of the sign is appro-
priate to the situation."[16]

Barring certain possible difficulties of psychological description
which the authors admit, at best we have here a situation describable
as psychological interbehavior with signs. No wonder that logical
propositions are regarded as superfluous. The argument is similar to
the declaration that no rifles are necessary in war because war is
really a process of digging trenches, so that spades and not rifles are
required.

Precisely here is the transparent fallacy of the recent transformation
of logical into language problems and the further reduction of linguis-
tic phenomena to signs and sign usages. The writers believe it is a great
advantage that what have hitherto been regarded as philosophical
problems of logic have turned out to be psychological. The question
arises, however, whether the description of sign behavior adequately
covers system building which is the essential feature of logical events.

Granting that the construction *a false proposition implies any
proposition* is only a sign implicitly interbehaved with (interpreted,

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15 Kaplan, A., and Copilowish, I. M., Must there be propositions? *Mind,*
1939, 48, 478-484.
16 *Ibid,* p. 482.

believed, understood) and further that the description of sign behavior is adequate, we still have no information concerning the work of constructing this product. And so in getting rid of some difficulties of traditional logic we have lost logic itself.

Despite the criticism of logicians who bring logic down to language problems it must be said that they are certainly well intentioned. Undoubtedly propositions have been identified with two objectionable things, Platonic essences on the one hand and inaccessible psychic states on the other. The question arises, on the other hand, how far the interests of logic are furthered by reducing logic to language or sign analysis.

For example, Russell who has moved from the extreme of Platonic realism to the psychologizing of all logic[17] by making logical words express "psychological attitudes" raises the question whether Kaplan and Copilowish have really rid themselves of propositions. Russell asserts they have simply substituted implicit behavior for propositions. What he means by a proposition he says is precisely this psychological attitude.[18] He insists that propositions must be distinguished from sentences; the former are definite psychological and physiological occurrences—complex images, expectations, etc. Propositions are expressed by sentences.

Undoubtedly the arguments for and against propositions have resulted in an important conclusion for logical study—namely, that when logical work is under investigation the activities of the logician must be taken into account. Surely this does not mean that logic is reduced to psychology. No more does logical interbehavior become identical with linguistic or general knowledge activity, though all are interrelated. In an attempt to clarify their differences and interrelations we undertake a brief descriptive analysis of these varying interbehaviors.

VARIATIONS IN INTERBEHAVIORAL FIELDS

Nature of Interbehavioral Fields. As we have already made clear an interbehavioral field is a basic unit of scientific description whether the data are physical, biological, or psychological. In each case the

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[17] Nagel, E., Mr. Russell on meaning and truth. *J. of Philos.*, 1941, 38, 253-270.

[18] Russell, B., An Inquiry into Truth and Meaning. New York, Norton, 1940, p. 236.

investigator describes what each factor does in the isolated event. Among the factors are to be numbered, of course, the primary things, say, light and the photoelectric cell and the conditions facilitating or inhibiting their interactions, for example, the presence or absence of inert gases in the cell.

In organic or human interbehavior one of the primary factors is an individual performing a particular kind of response. In many instances of human interbehavior there is a residue or result as a product. Such events we may designate as enterprises. By observing whether the interbehavior is simply an adjustment of some sort or an enterprise and further by taking account of type of enterprise we can differentiate between logical, psychological, linguistic, and knowledge fields.

The Psychological Field. Though in some sense every act of thinking, inquiring, inferring or knowing is a psychological action this fact need only be acknowledged when we are concerned with preanalytic data. When we analyze interbehavior in order to achieve basic constructions we are obliged to point out the differences between the different sorts of interbehavior. If we are primarily interested in logical propositions the inevitable psychological processes involved need only be treated in order to avoid inept or false descriptions.

An analytic psychological event constitutes a field in which the primary factors are mutually operating stimulus and response functions. These functions are respectively localized in the action of organisms and the action of the objects with which they are in contact.

A psychological event consists of an interbehavior in which an organism is in contact with stimulus objects. This interbehavior is conditioned by various factors: (1) behavior equipment in the form of responses which the organism has built up in prior contact with things, (2) stimulus functions gradually evolved by objects in such interbehavior, and (3) the settings which condition the interbehavior of organisms and objects.[19]

What is traditionally regarded as mental is simply such interbehavior. According to this objective scientific view there is no psychic, either in the form of sensations, consciousness, or a mind which can reason and transcend the boundaries of a person's contacts with things. Such contacts need not be direct, but may also be indirect, that is, by means of substitute stimuli.

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[19] Cf., Volume referred to in footnote 4.

The Logical Field. Here the individual's activities consist of system construction.[20] Logical systems, however, are not all of one sort; that is, the systems are built of various kinds of materials. Historically, as in the case of Aristotelian logic, the materials used were actual things in relation. The discussion and recording of these systems could only be handled with sentences as supplementary material and, so the tradition developed that logic consists of syllogisms in the sense of the interrelationship of propositions or sentences.

Today, of course, there is a tremendous inclination toward regarding mathematical or general relational propositions or even sentences as the sole materials out of which logical systems are constructed. When we study the work of logicians it is easy to see that that work is certainly characterized by system building but not by the materials or procedure. It is simply the overemphasis of their own favored system-building materials and procedure that blinds logicians to the legitimacy of their competitors' claim to be engaged in proper logical enterprises. Propositions, then, of various sorts, when materials or products of system building, merit the logical designation quite as well as things, events or linguistic items.

The Linguistic Field. Of the two types of linguistic fields, the referential and the symbolic,[21] only the latter calls for description as a possible item of confusion with logical fields. In the referential field the individual refers to stimulus objects in various ways and for various purposes; he asserts things, asks questions, etc. The audient interacts with things by way of being referred to them by someone. In such referential language no product factor is intended or required.

In the symbolic language field, on the other hand, the individual interacts with things by designating them, recording them, and generally by producing some product interrelated with the original stimulus object. The interpreter interbehaves with the symbols (products) by comprehending or being led to react with the things signified.

Now unless a logical system is built out of linguistic materials it is plain that even symbolic linguistic fields may be entirely independent of logical fields. We need only keep before us the type of enterprise going on. The fact that one tells what he does or records the system-

20 Kantor, J. R., Postulates for a Logic of Specificity. *J. of Philos.*, 1940, 37, 449-463.
21 Cf., Kantor, J. R.; An Objective Psychology of Grammar, Indiana University Publications, 1936.

building items need not prevent us from keeping the differing inter-behaviors segregated.

The Knowledge Field. Interactions with things of all sorts in this type of field lead to the development of opinions, beliefs, judgments, etc., concerning their nature, presence or absence, and what can or might be done with them. Criteria of the efficacy of the interbehaviors or their qualities are described as truth, falseness, determinacy, in-determinacy, etc. Knowledge interbehaviors may be regarded as psychological if they are private adjustments and do not constitute cultural accumulations. When they are cooperative actions, represent multipersonal interests and yield culturally acceptable results they may be considered as public or social knowledge. In the latter case the kinds of things investigated and the techniques employed may also be controlled by established and respected criteria.

Historically the methodological or inductive forms of logic have been identified with knowing fields, but the differences between system building and such knowing enterprises can be kept strictly apart.

Interrelation of Different Fields. In studying propositions it is not only important to map out the different fields but to recognize how they can be and frequently are interrelated. Especially in the case of logical propositions the worker is not only operating in a system-building field but in psychological and knowledge fields as well. It follows too that no complex enterprise can be carried on without records, symbolizations and other linguistic activities and things.

In the case of the interrelation of linguistic factors with proposition construction we can point out a general two phase rule. The first phase is participation. Here the mode of behavior is linguistic. By contrast with the manipulative processes which may be employed in systematiz-ing and ordering things directly, proposition building involves the secondary handling of things and relations by referential and symbolic substitution. The second phase is product embodiment. While propo-sitions may be constructed by the purely interbehavioral techniques of handling things referentially they cannot as products be exhibited or preserved without textual or symbolic recording or embodying.

Two Methods of Studying Propositions

As a further step toward the investigation of propositions we contrast the interbehavioral method of studying propositions with a

common alternative procedure which may be called the textual method. These contrasting methods throw into relief various important features of propositions.

The Textual Method. Those who use this method start with words or sentences, that is, symbols or transcribed texts, and then analyze these materials linguistically; for example, they begin with the sentence "Napoleon was short" and then assert that "was" formulates or expresses a belief, the other two words doing the same for the proposition believed.[22] At once a number of difficulties appear. What technical significance do the terms *formulate* or *express* possess? Now if these terms imply that opinion or belief constitute some sorts of "mental" processes which are somehow connected with words or texts the entire description runs counter to all scientific psychology. Again, on the basis of the implication that the words "Napoleon" and "short" symbolize a proposition, propositions become identified with things and relations. At best this method of studying propositions might be interpreted as offering a description of a psychological result especially if psychic factors are eliminated, but the entire procedure of constructing propositions whether for logical or non-logical enterprises is left out of account.

The Interbehavioral Method. The foregoing method stands in sharp contrast to the analysis of a work field. Here we observe the construction of propositions on the basis of many different kinds of interest and special procedures, such as inquiry, reflection or other interbehavior with (1) natural phenomena or with (2) assertions or propositions already prevalent in the field. Furthermore, it is discovered that propositions are not unique to logic but are types of interbehavioral products useful in any sort of intellectual work. In the case of both non-logical or logical propositions we can ascertain the background of the constructor, the sorts of problems in which he is interested, and the fidelity with which he patterns his propositions after the materials upon which he works.

THE ANALYSIS OF PROPOSITIONS

By setting forth the assumptions and techniques of studying propositions as factors of interbehavioral fields we have merely prepared the ground for analyzing propositions. Now we proceed to the analysis

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22 Ducasse, C. J., P.O.S.F. p. 704.

itself, in which several points stand out prominently. First, the origin of propositions is shown to constitute a most essential feature of their nature. Secondly, we compare propositions with other things with which they are improperly identified. Thirdly, we begin with propositions in general and later consider the particular characteristics of logical propositions.

Propositions as Interbehavioral Products. Propositions constitute products of human action in precisely the same sense as a musical composition, a painting or drawing, or a table. In each case the individual operates upon specific materials with a more or less definitely organized plan. While in making a table the manipulations involved are the most obvious, the performances in the other cases mentioned are not one whit different in principle. Since this is so, we need not hesitate to include the three kinds of products in the same class.

The materials interacted with in the production of propositions include every type and variety of object. They range from the most crassly manipulable objects to imagined (created) things or the materials of scientific operations. Whenever we have an authentic field of human interbehavior we have a potential location for the process of proposition production. The following table suggests the range of such materials and the propositions constructed from them.

Materials	Proposition	Field
Energy changes	The quantity of heat produced by the transformation of mechanical work is equivalent to work performed.	Physics
Energy changes	Energy radiation is discontinuous and is measurable in definite quantity.	Physics
Biological trait transmission	The characteristics of organisms are transmitted to their offspring by means of chromosomal material.	Biology
Historical	Essential incidents in national and international relations recur in whole or part.	Philosophy of History
Propositions	Logical propositions are basic to all science.	Logic
Realities	Spiritual essences are the most real.	Philosophy
Prime numbers	If n is any integer whatsoever and if p is a prime number, then the binomial $n^p - n$ is a multiple of p.	Mathematics
Psychophysics	Every psychosis is correlated with a neurosis.	Philosophy

Propositions	Propositions within a system must be demonstrated by apparatus not comprised in that system.	Logic
Muscle contraction	When individual muscle fibres are stimulated they give a maximal contraction or none at all.	Physiology
Human behavior	Haste makes waste.	Folk Wisdom
Light rays	In an inhomegeneous medium, a light ray travelling between two points follows a path along which the time taken is a minimum with respect to all paths joining the two points.	Applied Mathematics
Algebraic equations	Any algebraic equation must possess at least one solution real or complex.	Mathematics
Origin of inventions	Necessity is the mother of invention.	Folk Wisdom
Great men	Great men are the products of complex historical events.	History

Reflection as well as our examples indicates that propositions are not only organizations of features derived by abstraction from concrete or entirely created things, but that they are constructed or produced novelties. Depending upon the field in which they are constructed they may be variously described as hypotheses, guesses, speculations, or just plain fantasies. From the standpoint of psychological interbehavior propositions belong to the general range of events in which such creations as inventional ideas and scientific and artistic concepts are produced.

The Comparison of Propositions with Related Things. We now proceed to relate and compare propositions with factors with which they are identified or from which they are separated.

(a) *Propositions and sentences.* Probably most writers on logic differentiate propositions and sentences on the ground that sentences express propositions. This is both an acceptable and an unacceptable view. It is acceptable in the sense that we may distinguish between a proposition as a constructed referent and the sentence embodying it or symbolizing or referring to it. For example, the proposition that the area of no square can be exactly equal to that of a circle is separated from the discussion of that mathematical product. This discrimination is based upon the observation of two interbehavioral fields.

On the one hand, there is a complex interbehavior with points, lines, surfaces and relations, as the units of geometric figures (squares, circles) within the domain of Euclidean geometry. On the other, there are many fields, including the linguistic, in which the propositional product is the thing interacted with. Granted that the work of constructing this proposition involves besides thinking and imagination action also the use of pencil and paper, and that therefore words and symbols constitute processes and tools with which we construct a proposition, there is still no occasion to overlook the differences in the factors involved. From an analytical standpoint the use of such tools is accidental and not absolutely essential for the production of such a product. On the other hand, once we have developed this product we refer to it and record it. In both these instances it is metaphorically correct to say that the linguistic activities or the symbols recording them constitute expressions of the proposition.

Those who wish to ignore the work of creating the proposition and deal only with the reference to or recording of it as a product need not distinguish between propositions and sentences. It is important, however, to be clear concerning the two situations involved, in other words, to recognize two operational fields.

(b) *Propositions and meaning content of sentences.* Writers frequently describe a proposition as the significance or meaning content of a sentence. This description is subject to two interpretations, one of which we reject completely, whereas the other might be adapted to our own exposition. The rejected interpretation is that the signification or meaning content constitutes some sort of psychic element or process. Not only do we object to the introduction of psychic factors but also to overlooking that the proposition is a definite object, a relation or function developed in a concrete creative interbehavior.

If by the term *meaning content* one understands a proposition-referent which is symbolized or expressed by a sentence we can accept the description. It is doubtful, however, whether this objective interpretation of the terms *meaning content* and *expression* is widely recognized.

It is not difficult to account for the prevalence of the psychic interpretation of meaning content. Writers undoubtedly are misled by the fact that the product is not apparent and independently existing until it is embodied in a set of words or symbols. Let us assume

that a mathematician does not really have a theorem until he has written it out. In fact he may not be able to satisfy himself that he has constructed a theorem until he sees it in black and white before him. Nevertheless, the product made from observed or contrived relations need not be confused with any sort of psychic factor.

Again, it may be strongly argued that a proposition unembodied in words or symbols is not a complete product but perhaps only a process. In other words, it may be difficult to separate the nascent proposition from the action of forming it. This fact in no way, how-ever, suggests that the activity is not a completely objective inter-behavioral process or that the process by stages does not lead to a thoroughly objective creation.

At this point we face the problem of "logical"[23] existence. It is obvious that propositions only exist in interbehavioral fields and by virtue of interbehavioral events. As formulations of observed relations or constructions concerning events they exist only as abstractions. They are stimulus objects or referents dealt with through substitute stimuli (things or events) at the time of production and the same things or events plus sound or script when they are otherwise inter-acted with (referred to, studied, etc.). As factors (stimulus objects) in interbehavioral fields they are spatio-temporal and objective.[24]

An example of the evolution of a mathematical proposition may be used to clear up the points involved here. A mathematician working with prime numbers might create the notion (theorem) that for any value n to which 2^2 can be raised a prime number is obtained by the addition of 1. This proposition may be created by actually trying out such values for n as 0, 1, 2, 3, and 4, or the trying-out process may follow by way of demonstrating the truth of the proposition. In the former case the proposition is created by interacting with prime and compound numbers which are handled by verbal-action substitutes or by written-out integers. In both cases it is possible that the theorem-proposition has only been referred to verbally either in the construc-

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[23] We emphasize the term logical to indicate that it is here used in the conventional sense of something non-existing. In other words, it does not exist as tables and planets exist. An example frequently given of such non-existents is a hippogriff.

[24] We firmly oppose Dewey's assertions (Logic, 45, 117, 271, *et passim*) concerning the non-temporality of propositional terms and relations. Such as-sertions certainly imply an objectionable view concerning the non-naturalistic character of logical things and events.

tional procedure or after the notion was created. The whole set of operations need only be described as completely objective events.

Only when the mathematician is satisfied that he has created a valid theorem does he write it down, perhaps only in a letter to be sent to someone for testing. Such sentences in which the proposition is referred to or represented as in the formula $2^{2^n} + 1 = p$ constitute definite things added to the proposition or theorem.

(c) *Propositions as facts.* Ducasse has recently set up and defended the assertion that propositions are facts, if only they are true propositions. His argument may be illustrated as follows. The sentence "This paper is combustible" constitutes a verbal symbol of an opinion which can be analyzed into two parts: (1) an epistemic attitude (belief) and (2) a proposition believed. Now if this proposition is true, Ducasse argues, it is the same as a fact because both parts of the proposition are physical entities, paper and combustibility.[25]

The argument is centered first in a linguistic and secondly in an epistemological situation. As to the former, Ducasse regards the sentence or assertion as a symbol of the proposition and therefore not the proposition. Epistemologically he contrasts the belief with what the belief is about and since he calls the latter a proposition he thinks he has established the identity of a proposition and a thing or event.

When the question is raised how combustibility and paper, in other words, things and events, can be constituents of propositions there are two answers. In the first place, since Ducasse is concerned with sentences or linguistic materials it is not difficult for him to separate the reference or symbol (sentence) from the referent (event). By simply calling the referent a proposition he can identify the two. In the second place, objective events or things he reduces to mental states, so that at least in some instances *esse est percipi.*[26]

Ducasse's exposition of a linguistic situation is far removed from an actual propositional field. Here the fact that the sentence is not the proposition does not allow us to describe the referent as the *thing talked* about, as it might in the linguistic case. In the present instance it is overlooked that the proposition-product has no manner of identity

[25] Ducasse, C. J., Is a fact a true proposition? A reply. *J. of Philos.,* 1942, 39, 132-136.
[26] Cf., for example, Ducasse, C. J., Objectivity, Objective Experience, and Perception. *Philosophy and Phenomenological Research,* 1941-2, 2, 43-78.

with the things from interaction with which it has been derived. In an actual propositional situation we must first have a problem as to the combustibility of something, then some interbehavior with it leading to the formation of a proposition. This proposition may be formulated as a verbal statement concerning the findings with regard to the thing in question. And finally a verbal or symbolic statement may be concocted referring to or transcribing the proposition.

Instead of the three factors Ducasse analyzes out of linguistic situations—namely, sentence, epistemic attitude, proposition-thing, a propositional situation may be analyzed into a large number of factors. For example, (1) an object presenting a problem, (2) a belief (hypothesis) about it, that it is combustible, (3) some act or operation upon the object, (4) the discovery or assurance that it is combustible, (5) the formulated proposition, and (6) the embodiment of the proposition in verbal or symbolic form.

Logical and Non-logical Propositions.   The proposition discussed in the preceding paragraphs is clearly not a logical proposition. As our illustration indicated, the field in which it is localized is perhaps a scientific one. Propositions, as we have already asserted, constitute products resulting from interbehavior with all sorts of things and in all manner of situations. Propositions are constructed in everyday life, as well as under scientific and logical circumstances. So wide is the scope of propositions that they range from individual or personal constructions in purely private situations to the conventionally formulated public constructions which carry the name of laws and basic intellectual principles. Such facts have a decided influence upon the nature of propositions.

Once we have observed that the most precisely formulated logical propositions are in principle like the privately developed casual propositions we need not anticipate any difficulty of separating them as a basis for analysis. It is of some importance, however, to distinguish between logical and non-logical propositions which are closely related. For this purpose we differentiate between (1) non-logical propositions, (2) metalogical propositions, and (3) strictly logical propositions.

(1) *Non-logical propositions.*   Here we are concerned with propositions or constructions based upon interbehavior with logical systems. For example, p(there are infinitely many logics), p(logic is not a

unique power or process but rather a specific enterprise).[27] The main point is that these propositions are not integral factors of systems of propositions; they may be constructed as single unit products isolated from other units.

(2) *Metalogical propositions.* These propositions constitute the factors or materials of a system basic to a logic. They may be described as the axioms, postulates or rules according to which particular logical systems are to be constructed. It is assumed that they are integrated into a unit. Examples of metalogical propositions are: p(the propositions or factors of this system complete it), p(the propositions or factors x and y of this system render it inconsistent), p(the organizations of things x, y, z, etc., render system K satisfactory for specification S).

(3) *Strictly logical propositions.* These propositions are always members of unique systems organized according to stated criteria which if met constitute satisfactory unit structures. We stress again that what the propositions concern or are derived from cannot be made a criterion; the latter concerns only the organization and interrelationship of the propositions. Strictly logical propositions may be constructed to organize things, relations, sentences, or statements. The theorems of a mathematical system are examples.

PROPERTIES OF LOGICAL PROPOSITIONS

Since logical propositions are constructed and operate in system-building enterprises their general properties depend upon the nature of such enterprises. There is, of course, no general acceptance by logicians of the interpretation that logic is essentially a system-building enterprise. On the contrary, logic is most frequently correlated with epistemological studies. Accordingly the properties usually ascribed to propositions are truth and falsity. Truth and falsity thus not only reflect the epistemological attitude, but also imply that propositions are linguistic in character.

A notable exception is the view of Dewey. Starting with the notion that propositions are instruments for determining problems in inde-

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27 We adopt the transcriptive scheme, p(__), to refer to propositions as compared with other referents.

terminate situations Dewey[28] denies that truth and falsity are prop-erties of propositions. Rather, since propositions are means they are effective or ineffective, pertinent or irrelevant, wasteful or economical, valid or invalid, loose or rigorous, etc. In spite of the fact that Dewey does not depart radically from the view that propositions are linguistic, his epistemological view of logic does add new properties to the con-ventional ones.

Another interesting exception is Ducasse's true proposition which he identifies with a fact that simply is or exists. Of such propositions it would be redundant to say that they are true and, of course, they cannot be false. This notion is part of Ducasse's peculiar doctrine of unconsidered propositions which have never yet been believed, doubted, or supposed by anybody.[29]

From an interbehavioral standpoint it is a great advantage to enlarge the number of propositional properties. To do so suggests at once that propositions vary with the situations in which they operate and that as a consequence there are many kinds of propositions pos-sessing a large number of properties.

Since we are concerned primarily with logical propositions we can separate their properties into two classes. The first class comprises properties pertaining especially to system building, among them being coherence and fittingness. In many cases, for example, in those in which the systems are primarily constructions and the materials abstracted relations or pure creations, these may be the exclusive properties. On the other hand, when the systems are organizations of concrete things or events then the propositions may also possess prop-erties of truth, falsity, probability, necessity, and the others mentioned by Dewey.

(a) *Propositions as true or false.* Since we cannot share Dewey's opinion that propositions are always means employed in epistemologi-cal enterprises, but on the contrary claim they may be simply items in constructed systems there is no point to ruling out truth and falsity as properties of logical propositions. If one grants that propositions constitute products resulting from the investigation of things they can be classified as true or false on the basis of whether they do or do not

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[28] Dewey, J., Logic: The Theory of Inquiry. New York, Holt, 1938, p. 287.
[29] P.O.S.F., p. 701.

conform to or correlate with those things or events. We repeat that these propositional properties are certainly not the exclusive ones. And certainly truth and falsity cannot be exclusively the properties of propositions as Ducasse[30] holds. There is no good reason at all why we cannot take truth to be the correlation of an opinion and an event or an assertion and an event.

At this point it is important to note that only on conventional grounds can one deny that false propositions can be organized into logical systems.[31] To admit that they can we need but withdraw from an enterprise based on epistemological criteria to one adopting a criterion of system organization.

(b) *Propositions as coherent or fitting.* As we have said, when essentially system-building enterprises are in question the important properties of propositions consist of belongingness or fittingness. The significant point is not whether the propositions correlate with the eixstence of things and relations but whether they fit into the system. If they do they are correct or coherent, otherwise not. The criterion here perhaps is consistency rather than fidelity to fact.

Depending upon the enterprise engaged in, many propositions possess such properties as useful or useless, rigorous or non-rigorous, timely or untimely, sensible or nonsensical, etc. We need only keep before us the idea that logic is not a single, universal, and absolute system. On the one hand, we must allow for purely formal systems in which only the coherence of propositions is involved—on the basis, perhaps, that they are not mutually contradictory. On the other, if we consider that logical systems are not necessarily made up of propositions at all we need not insist upon any absolute rigor in propositional organization.

(c) *Predicative properties of propositions.* Logicians harboring a linguistic bias concerning propositions insist that they possess predicative properties. Those, on the other hand, who can accept the theory that propositions are interbehavioral products consisting of hypotheses, laws or other things developed on the basis of the properties or relations of things need not regard predication as any sort of property of either logical or non-logical propositions.

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30 P.O.S.F., p. 706.
31 Cf., Lewis, C. I., Mind and the World Order. New York, Scribners, 1929, p. 209.

OPERATIONS WITH PROPOSITIONS

Once propositions have been constructed they can then be manipulated and dealt with in various ways. One can interact with them by way of referring to them, becoming cognizant of them and storing them up as records of knowledge and discovery or as heritages of culture. Doubtless one of the most important ways of interacting with propositions is by altering them to accord with more recent and more effective ways of performing actions which result in deriving them. The important point is to regard them as things similar to such items as esthetic criteria, legal principles and other impedimenta of complex civilization.

The thing and product character of propositions is excellently illustrated by the opinion that at least considerable knowledge consists of propositions.[32] Obviously it is impossible for every scientist to determine the nature and relation of all the events in his field of study; hence he must accept the established constructions concerning them. Under the most favorable circumstances these constructions are, of course, effectively derived from contact with original objects and events. From a psychological standpoint propositions may be described as stimulus objects with which individuals interact. Because of their nature they must, therefore be interacted with substitutively. To interbehave with the proposition p(two straight lines cannot enclose a space) or p(two straight lines can enclose a space) it must be brought to the individual by word of mouth or script.

Important interactions with propositions consist of studying them by way of criticism, analysis and classification. In other words, they can be treated with respect to the events or other original materials they bring together or with respect to the system in which they are to play a part. Propositions in the latter sense may be regarded as tools for certain purposes, and they can be examined from the standpoint of whether they are sufficient or available for the purpose.

Propositions may be manipulated as elements in system building. For example, mathematical postulates and axioms may be set up and theorems, lemmas and corrolaries constructed with a view to organizing a consistent set of propositions concerning certain mathematical relations.

[32] Cohen, M. R., and Nagel, E., Introduction to Logic and Scientific Method. New York, Harcourt, Brace, 1937, p. 29.

A fundamental point concerning operations with propositions is to follow rules of derivation. For example, in all scientific work we find that propositions derived from certain fields are accepted as parts of the scientific structure in others. The most striking examples are the incorporation in other propositional systems of propositions derived from physics. This leads to the glorification of the propositions of physics as over against the whole range of events from which they are derived.

LOGICAL IMPLICATIONS OF INTERBEHAVIORAL ANALYSIS

We conclude by pointing out two implications which the inter-behavorial theory of propositions carries for logic.

One of the most prominent of the perennial problems of logic concerns the relations it sustains to psychology. Essentially this problem involves the logicians' ambition to achieve objectivity and certainty, to establish norms that will hold for all the sciences including psychology, and likewise to discover necessities in things independently of how anyone actually thinks about them. This ambition they attempted to realize by developing systems of propositions which of themselves necessarily imply each other.

Unfortunately such a technique carried within it the germs of a troublesome paradox. As we know, the most objective mathematical and symbolic logics have run into problems demanding the consideration of meanings and interpretations of propositions. Anyone viewing the logical scene today must be impressed with the rapid turnover of ideas among formal logicians. Observe how Russell and Carnap have shifted their positions from the ultraformalism of propositions (syntacticism) to semantics. Indeed it is hardly reasonable to believe that psychology should have no voice in determining what propositions are, whence they are derived and the nature of their significance.

The Problem of Objectivity. In the early days of mathematical logic the problem of objectivity appeared to be definitely settled, with logic taking the shape of mathematics and departing from the classical subject-predicate form. It thus appeared that logicians need no longer be concerned with psychological issues. The employment of definite and exact symbols carried the logician away from the irrelevancies of meaning and the subjective thought of the user. Incidentally, as the records of logic show, there was a decided trend toward a preoccupa-

tion with Platonic essences, which, of course, were infinitely removed from subjective concepts and thoughts. The attack upon psychologism by such leaders in this movement as Husserl, Frege, Meinong, and Russell appeared to vanquish completely the hoards of psychologic notions heretofore entangling logic.

On the other hand, the victories of antipsychologism themselves occasioned various sorts of issues which were inevitable when the trend of development came to be not the reduction of logic to mathematics but the reduction of mathematics to logic. We are reminded here of Thomae's reference to the extreme formalists in mathematics as thoughtless thinkers.[33]

Now if psychology itself is an objective science and if propositions are interbehavioral products nothing is lost by taking account of the activity of persons and much is gained by considering the objects with which they interact.

The Problem of Norms. The interbehavioral view of propositions implies that while no absolutism can be achieved by taking propositions as they stand independently of the constructors, there is no inter- ference with the notion of rigid norms. It is certainly no hardship to take cognizance of the fact that logic and its propositions have to do with specific systems and particular enterprises no matter how abstract. We have only to observe that propositional norms are functions of the materials they bring together or the rigidity of the system one wishes to establish. Whoever sets up propositional systems that are absolute and transcend all interbehavioral situations obviously lands in pure verbalism. On the other hand, to keep in touch with the worker and what he works with is to allow the basic importance of logic to reveal itself, whether the materials worked with comprise the abstract rela- tions of mathematics, objects and events in science, or any other things used in system construction.

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[33] Cf., Klein, F., Elementary Mathematics from an Advanced Standpoint. (E. R. Hedrick and C. A. Noble, trs.) New York, Macmillan, 1932, p. 15.